DESCRIPTION OF VIVIANITE ENCRUSTING A FOSSIL TUSK FROM GOLD PLACERS OF CLEARWATER COUNTY, IDAHO.

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The only locality for the ferrous phosphate, vivianite, in Idaho which has heretofore been mentioned in mineralogic literature is the Silver City mining district, in Owyhee County, in the southwestern part of the State. The mineral occurs as crystals embedded in clay in the veins of several silver mines. A large crystal from this locality has been described and figured by Farrington and Tillotson.[1] The purpose of the present short paper is to call attention to several vivianite specimens which are now in the United States National Museum (Cat. No. 87220) and which occurred under very different conditions in Clearwater County in the northern part of the State. These, which are broken parts of what was originally one mass, were received as a gift from Messrs. Charles Brown and John Pearson, of Dent, Idaho, through Mr. W. B. Compton, who writes that the material was found in a gold placer mine 17 feet below the surface. The extreme fragility of the specimen proves conclusively that the mineral was formed in the situation where found. The largest specimen, which is illustrated in Plate 93, has the form of a hollow, curved, tapering cone, which is somewhat triangular in cross section and is composed entirely of crusted crystals of vivianite. The general shape of the object was so suggestive of that of a horn or tusk that it was submitted for examination to Messrs. James W. Gidley and Charles W. Gilmore, of the Division of Vertebrate Paleontology in the United States National Museum, who both agree that the deposit represents the mold of a horn or tusk, but owing to the total removal of all of the original material and the absence of definite structure in the crystalline vivianite remaining, definite opinions could not be given as to the exact character of the animal to which it belonged. Mr. Gidley thinks that the original object was probably the horn of a long-horned bison or the tusk of a walrus, the point being too acutely tapering to be the tip of a mammoth tusk. Mr.

[1] Farrington, O. C., and Tillotson, E. W., jr., Field Col. Mus. Bull., Geol. Series, vol. 3, p. 163, 1908.

Gilmore, however, has pointed out a tendency of tusks of the mammoth to develop a cone-in-cone structure and to separate upon weathering into a succession of horn-shaped segments having much the form of the interior cavity of the vivianite specimen. On chemical grounds the writer is inclined to eliminate horn from consideration, as the tip portion of a horn of this length, owing to its relatively low content of mineral matter, would scarce supply the amount of phosphoric acid represented by the vivianite.

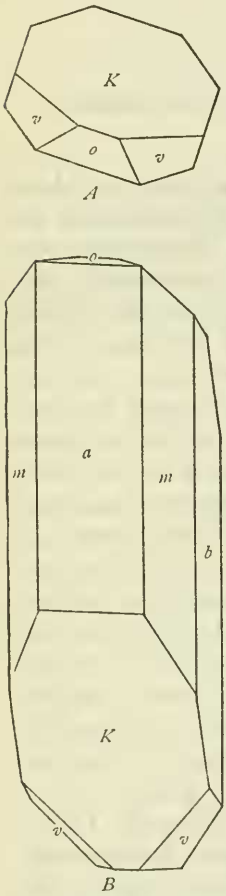

FIG. 1.—CRYSTAL OF VIVIANITE.

The exterior of the specimen, as shown by the photograph, is made up of masses of vivianite crystals. The crystals are grown outward from a thin platy layer which, while also consisting of vivianite, apparently outlines the original object and has a remotely fibrous appearance as though deposited between thin plates of bony material which had exfoliated somewhat under the influence of weathering. Inside the cone there is a second layer of vivianite crystals which have grown inward from the platy layer. The latter are much smaller than those of the exterior layer. The central cavity of the specimen is in part filled with sandy material, grains of which are embedded in the surfaces of the crystals of the interior crust. Under the microscope this sandy material is seen to consist of angular grains of quartz, small masses of partly kaolinized feldspar containing green hornblende, plates of muscovite, hexagonal scales of green chlorite, and angular fragments of garnet embedded in a clayey matrix largely composed of sericitic muscovite. None of these mineral grains are water worn and the material is such as might result from the residual decomposition of a granitic rock.

The crystals of the exterior crust are well formed and are aggregated into groups the individuals of which deviate a few degrees from strict parallelism. These are developed in a manner showing that they grew freely without interference, and there are no grains of sand or of other substance attached to the crystals nor do the faces contain the impressions of any such grains. Some of the intercrystal recesses contain a peculiar waxy limonite which appears to have been a gelatinous colloid which shrunk upon drying, becoming thus filled with shrinkage cracks. This limonite is readily brushed away from the vivianite crystals, leaving them smooth and bright. In just

what sort of medium these could have developed is not clear. It must have been either a yielding homogeneous fine grained muck or an open cavity. If it were muck the sand which occupies the center of the specimen must have been packed in the interior of the original object when it was deposited. It is possible that the crystal crust grew upon a shell formed around the sand on the interior of the original tusk and found space to grow in the cavity formed by the solution and removal of the tusk itself.

Individual crystals of the vivianite reach a maximum length of 2 centimeters with a diameter of 1 centimeter, while aggregates of crystals in nearly parallel position reach a length of 4 centimeters with a thickness of 2 centimeters.

The crystals are all alike in development, being prismatic by elongation of the prism $m(110)$, the orthopinacoid $a(100)$, and the clinopinacoid $b(010)$. The terminations are wedge shaped and consist of $o(\bar{1}03)$, $v(\bar{1}11)$, and $K(\bar{3}01)$, the dominant orthodome $K(\bar{3}01)$ being a form not previously recorded on vivianite. The form and development of the crystals are as shown in orthographic and clinographic projections in figures 1*A* and 1*B*. The faces of $m(110)$ are in all cases clear and brilliant, yielding excellent reflections of the signal. The orthopinacoid $a(100)$ is always more or less irregular, while $b(010)$ is usually dull. The terminal planes are always more or less etched and dulled, sometimes to such an extent that no light is reflected at all. The new dome $K(\bar{3}01)$, while present as a broad face, yielded blurred signals which did not permit accurate measurements. The average angle obtained from several readings is as follows:

Angles of dome $K(\bar{3}01)$ on vivianite.

Letter.	Miller.	Gdt.	Calculated.		Measured.	
			ϕ	ρ	ϕ	ρ
K	$\bar{3}01$	$\bar{3}0$	90°00′	68°37′	90°24′	67°45′

Since the calculated and observed angles are nearly 1 degree apart and the reflections were of poor quality, this must be regarded as a somewhat doubtful form.

In color the vivianite is light greenish blue, although this is obscured by the presence between and around the crystals of a pulverulent deep blue alteration product. The cleavage parallel to $b(010)$ is very prominent, yielding flexible laminae. Under the microscope the pleochroism of some grains is very striking and beautiful.